

REMARKS

In the Office Action dated July 10, 2007, the Examiner rejected claims 19, 20, 22-27, 33 and 34 under 35 USC 102 as anticipated by Kinsman in US patent publication 2002/0027257, rejected claims 21 and 28-31 under 35 USC 103 as obvious over Kinsman, rejected claims 35-42 under 35 USC 103 as obvious over Capote in US patent publication 2002/0014703 and Pasadyn in US patent 6,605,474, and rejected claims 32 and 43 under 35 USC 103 as obvious over Kinsman, Capote and Pasadyn. In response thereto, the Applicants have amended claims 19 and 35. Claims 19-43 remain at issue.

The Claim Amendments

The Applicants have amended claims 19 and 35 to correct a typographical error and better clarify that the reflowable underfill adhesive has physical properties that make it suitable to reflow at solder reflow temperatures. While the Applicants submit that these claims previously contained the same limitation, the claims have been amended to make it absolutely clear that these limitations are not product-by-process limitations, but rather, are drawn to the physical properties of the claimed structure itself. The undersigned therefore submits that these amendments do **not** alter the scope of the claims, nor do they require a new search. Consequently, these amendments should be entered in spite of the final rejection.

The Art Rejection

The Examiner states that certain claims are anticipated by Kinsman. The Applicants strongly disagree. Kinsman does not anticipate any of the claims of the present application.

In the Office Action dated July 10, 2007, the Examiner states in paragraph 2 of the rejection that the underfill adhesive 30 of Kinsman is reflowable. Specifically, the Examiner states “***Moreover, the underfill is reflowable at the reflow temperature of the solder bumps.***” The examiner, however, provides no support for this statement. The undersigned has carefully reviewed the specification of Kinsman. There is absolutely no teaching whatsoever indicating that the material 30 that is applied to the semiconductor substrate 10 of Kinsman has physical properties enabling it to be ***re-flowed***. On the contrary, the material is initially flowed onto the substrate, is cured, and then is apparently permanently set. The reference fails to teach that the material reflows, as discussed in detail below.

In the Brief Summary of the Invention, Kinsman teaches that a “flowable” material is used to encapsulate the active surface of a **semiconductor** wafer. Kinsman does **not** teach or mention that the material 30 can be **re**-flowed.

In paragraph [0026], Kinsman teaches that the flowable encapsulant material 30 is applied to the entire active surface of the wafer. After the encapsulant 30 has been “*sufficiently cured to a substantially rigid state*”, the surface of the encapsulant is planarized.

Paragraph [0026] further states that the encapsulant 30 forms a “*hermetic seal*” over the substrate.

In paragraph [0029], Kinsman discusses the formation of solder balls 32 on the surface of the substrate by applying a solder paste and then reflowing the solder paste to form the balls 32. Although Kinsman discusses heating the substrate to a temperature sufficient to cause the solder to reflow, there is absolutely no mention of the material 30 reflowing as well.

Paragraph [0033] with reference to Figure 2, Kinsman discloses how encapsulant material may be applied to both the active and backside of the substrate.

Lastly in paragraph [0036], Kinsman discloses an alternative embodiment where the encapsulant 30 is patterned using conventional photolithography to form recesses and then the recesses are filled with a solder paste to form conductive elements 40, as illustrated in Figure 4.

Kinsman therefore clearly does **not** teach that the material 30 is **re**flowable. The entire premise of the Examiner’s rejection is therefore based on an incorrect interpretation of the reference. Kinsman consequently does **not** anticipate any of the claims of the present invention.

A careful review of Kinsman demonstrates that the reference actually *teaches away* from the present invention as claimed. Paragraph [0026] of Kinsman specifically states that the encapsulant material 30 forms a “*hermetic seal*” over the integrated circuitry 18 on the active surface 14 of the substrate. If the material 30 of Kinsman were to reflow like the underfill material of the present invention, there is a strong possibility that the hermetic seal would be broken, exposing the underlying circuitry 18. Since Kinsman specifically teaches the formation of a hermetic seal, it is proper to conclude that the seal material is not **partially cured, nor does it reflow.**

Certain other claims have been rejected based on the combination of Capote and Pasadyn. The Applicants strongly disagree. The Examiner has failed to demonstrate a prime facie case of obviousness.

The Capote publication teaches various methods for applying an encapsulant material 22 that is applied using either a liquid that is hardened or an adhesive tape that is applied to a chip.

In Figure 12 for example, the encapsulant material 22 is a film laminated onto a tape. See paragraph [0036].

In the Figure 4 embodiment, the chip 10 is pre-coated with the encapsulant material 22 prior to assembly to the substrate 20. Specifically, the encapsulant is uniformly spread across the surface 16 of the chip 10 between the solder bumps 14. See paragraph [0037].

In the Figure 5 embodiment, the chip 10 is coated with a high temperature thermoplastic adhesive 19 and film 21 (see figure 12), then the contact pads 24 are exposed by making vias through the encapsulant 22 with a laser, plasma or chemical etch, photo-imaging, etc. See paragraph [0038].

Contrary to the Examiner's statements in the rejection, there is no discussion whatsoever in paragraph [0038], or elsewhere in the reference, teaching or suggesting the cutting of the edges of the encapsulant 22.

In the Figure 10 embodiment, the chip 10 is pre-coated with a first film 37 laminated onto the chip 10 while the substrate 20 is pre-coated with a second film layer 39. Together, the first and second films form the encapsulant material 22. See paragraph [0039].

The Capote reference thus teaches the application of either an adhesive tape or a liquid that is applied and hardened onto a surface of a flip chip. Nowhere, however, does Capote teach or suggest a flip chip having a substantially uniform layer of underfill adhesive where the flip chip and the underfill adhesive material, together, form continuous cut edges around the periphery of the flip chip. Capote therefore does not anticipate or suggest the present invention as claimed.

The Pasadyn reference is directed toward a method of identifying operational and defective die on a wafer. Other than both being broadly directed to semiconductors, the Capote and Pasadyn references have absolutely nothing in common. There is absolutely no reason why one of ordinary skill in the art working in the area of flip chip packaging would consider a reference related to the testing of dice on a wafer and vice versa. The two references are therefore not combinable as suggested by the Examiner.

Furthermore, even if it were proper to combine the two references, it still would not result in the present invention as claimed. Instead, the proposed combination would result in the flip chip of Capote that is tested while still in wafer form using the metrology technique as taught by Pasadyn. The proposed combination, however, would not teach a wafer having a partially cured underfill adhesive layer formed on the active surface of a flip chip wafer.

Lastly, the two references actually teach away from one another. The Capote reference explicitly teaches the application of either an adhesive tape or a liquid that is applied and

hardened onto a surface of an individual flip chip, whereas the Pasadyn reference is directed to using a metrology tool to identify good and bad die on a wafer. One reference is therefore at the wafer level, while the other is at the chip level. The two references therefore teach away from one another.

Therefore, the Examiner has failed to demonstrate a prima facie case of obvious. The claims rejected based on the combination are therefore allowable.

The Applicants' believe that all pending claims are allowable and respectfully request a Notice of Allowance for this application from the Examiner.

Respectfully submitted,
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